

This is a continuation in part of application Serial No. 09/942,839 filed on

now abandoned.

[0001] Industrial reactions between reactant gases and liquids such as those involving hydrogenation of unsaturated organic compounds and those having functional groups capable of condensation are often performed by using finely divided powdered slurry catalysts in stirred-tank reactors. These slurry phase reaction systems are inherently problematic in chemical process safety, operability and productivity. The finely divided, powdered catalysts are often pyrophoric and require extensive operator handling during reactor charging and filtration. By the nature of their heat cycles for start-up and shut-down, slurry systems promote co-product formation which can shorten catalyst life and lower yield to the desired product.

[0002] An option to the use of finely divided powder catalysts in stirred reactors has been the use of pelleted catalysts in fixed bed reactors. While this reactor technology does eliminate much of the handling and waste problems, a number of engineering challenges have not permitted the application of fixed bed reactor technology to the reaction of gases with liquid organic compounds. Controlling the overall temperature rise and temperature gradients in the reaction process has been one problem. A second problem is that in fixed bed packed reactors there is a significant pressure drop due to the high flow rates required for hydrogenation. A third problem is that liquid-gas